

CLAIMS

1. A boron phosphide-based semiconductor light-emitting device comprising:

a substrate of silicon single crystal;

a first cubic boron phosphide-based semiconductor layer that is provided on a surface of the substrate and contains twins;

a light-emitting layer that is composed of a hexagonal Group III nitride semiconductor and provided on the first cubic boron phosphide-based semiconductor layer; and

a second cubic boron phosphide-based semiconductor layer that is provided on the light-emitting layer, contains twins and has a conduction type different from that of the first cubic boron phosphide-based semiconductor layer.

2. A boron phosphide-based semiconductor light-emitting device according to claim 1, wherein the substrate is a (111)-silicon single-crystal substrate having a (111) crystal plane, and the first cubic boron phosphide-based semiconductor layer is provided on the (111) crystal plane.

3. A boron phosphide-based semiconductor light-emitting device according to claim 2, wherein the first cubic boron phosphide-based semiconductor layer has a [110] direction aligned with a [110] direction of the silicon single crystal.

4. A boron phosphide-based semiconductor light-emitting device according to claim 2 or claim 3, wherein the

first cubic boron phosphide-based semiconductor layer contains (111) twins having a (111) crystal plane serving as a twinning plane in a junction area in contact with the (111) crystal plane of the (111)-silicon single-crystal substrate.

5. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 4, wherein, the first cubic boron phosphide-based semiconductor layer is an undoped layer to which no impurity element has been intentionally added.

6. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 5, wherein the light-emitting layer has a $[-2110]$ direction aligned with a $[110]$ direction of the first cubic boron phosphide-based semiconductor layer and has a (0001) crystal plane serving as a front surface.

7. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 6, wherein the light-emitting layer has a profile of phosphorus atom concentration that gradually decreases from a bottom thereof in a thickness direction.

8. A boron phosphide-based semiconductor light-emitting device according to claim 6, wherein the second cubic boron phosphide-based semiconductor layer has a $[110]$ direction aligned with the $[-2110]$ direction of the light-emitting layer.

9. A boron phosphide-based semiconductor light-emitting device according to any one of claims 6 to 8, wherein the second cubic boron phosphide-based semiconductor layer contains (111) twins having a (111) crystal plane serving as a twinning plane in a junction area in contact with the (0001) crystal plane of the light-emitting layer.

10. A boron phosphide-based semiconductor light-emitting device according to any one of claims 6 to 9, wherein the second cubic boron phosphide-based semiconductor layer is an undoped layer to which no impurity element has been intentionally added.

11. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 10, wherein the first and second cubic boron phosphide-based semiconductor layers exhibit a bandgap at room temperature of 2.8 eV or more.

12. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 11, wherein the first and second cubic boron phosphide-based semiconductor layers are provided so as to serve as cladding layers.

13. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 11, wherein the second cubic boron phosphide-based semiconductor layer is provided so as to serve as a window layer which allows passage of light emitted from the light-emitting layer

to the outside.

14. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 11, wherein the second cubic boron phosphide-based semiconductor layer is provided so as to serve as a current-diffusion layer which allows device operation current to diffuse.

15. A boron phosphide-based semiconductor light-emitting device according to any one of claims 1 to 11, wherein the second cubic boron phosphide-based semiconductor layer is provided so as to serve as a contact layer for forming an electrode.